

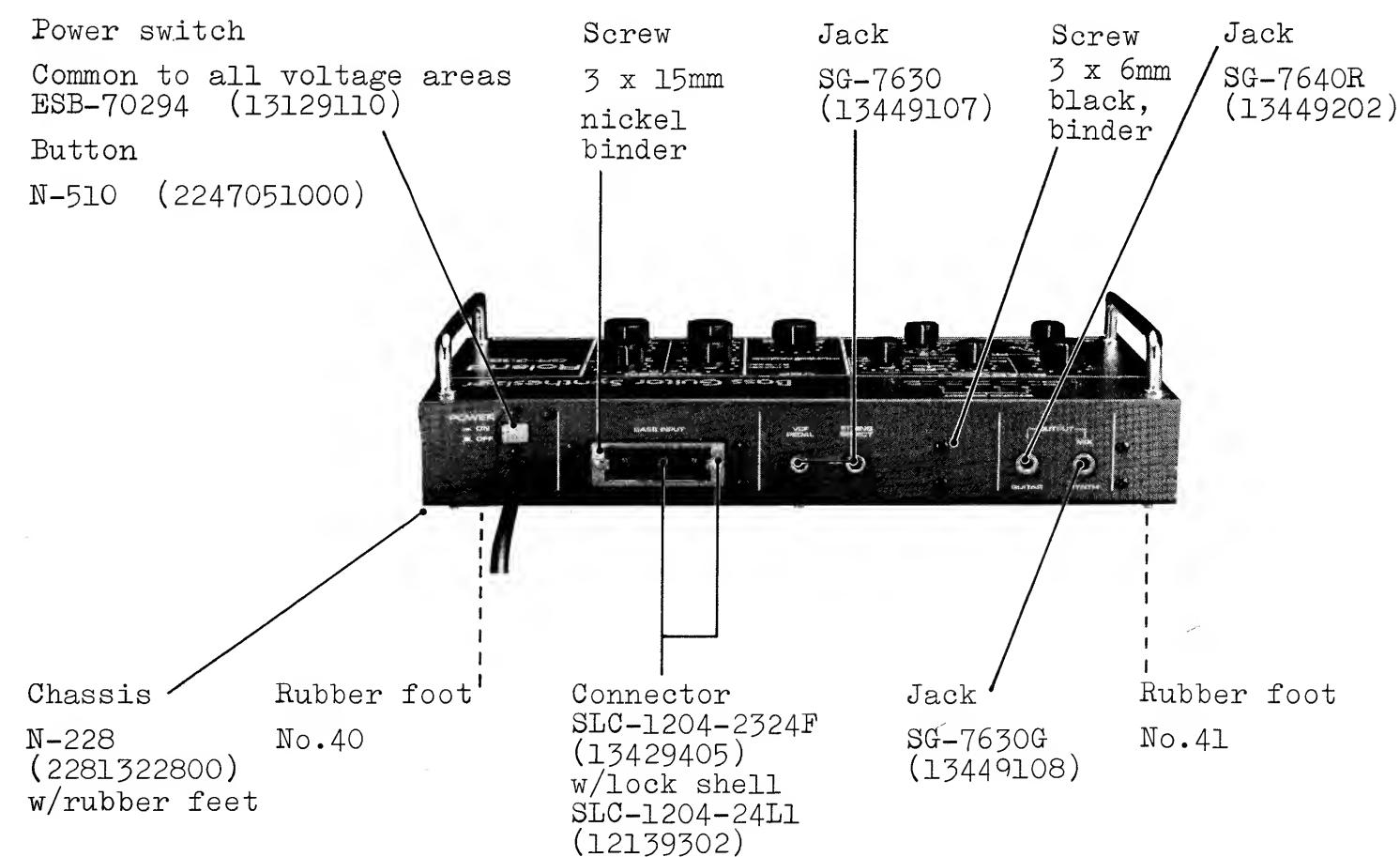
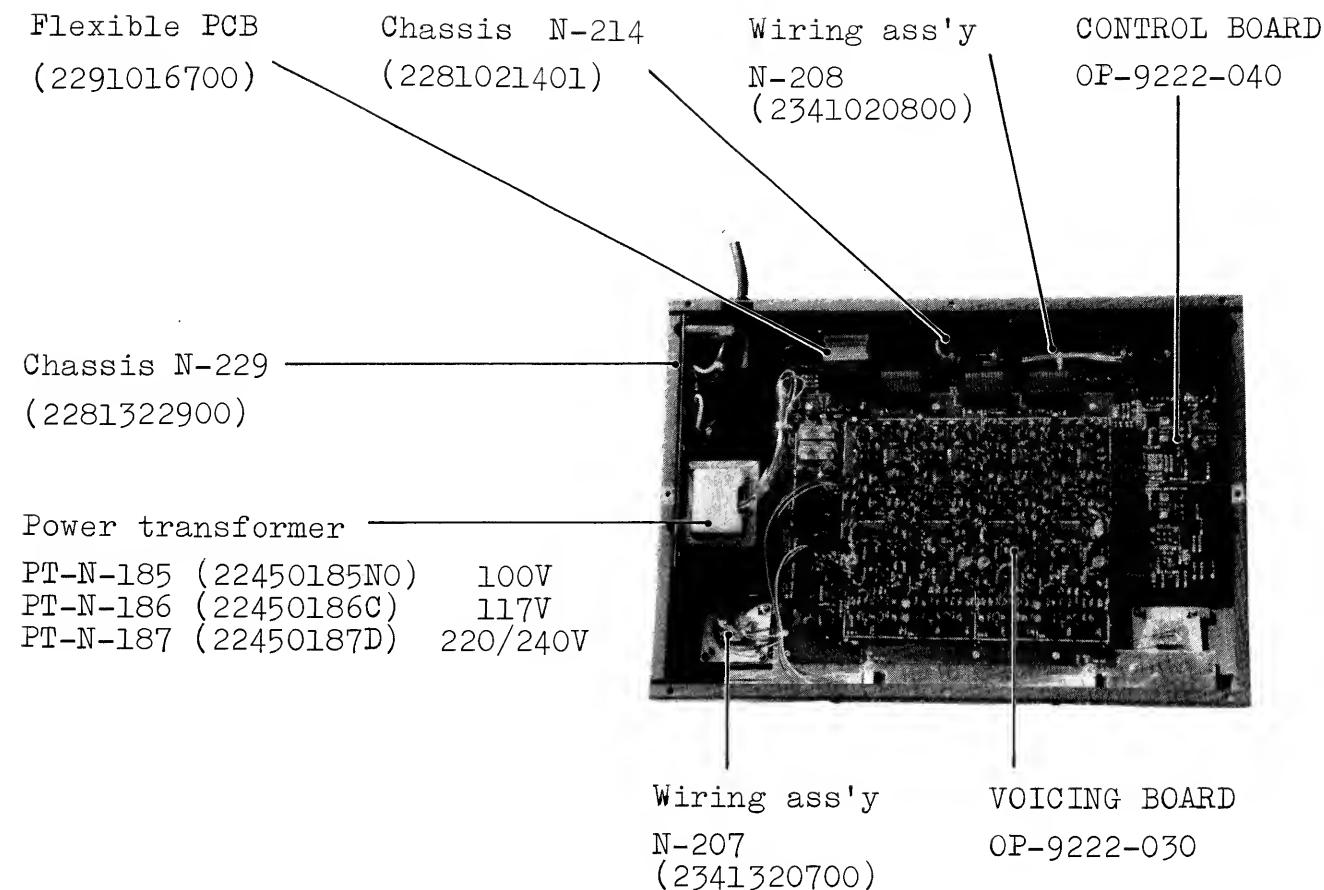
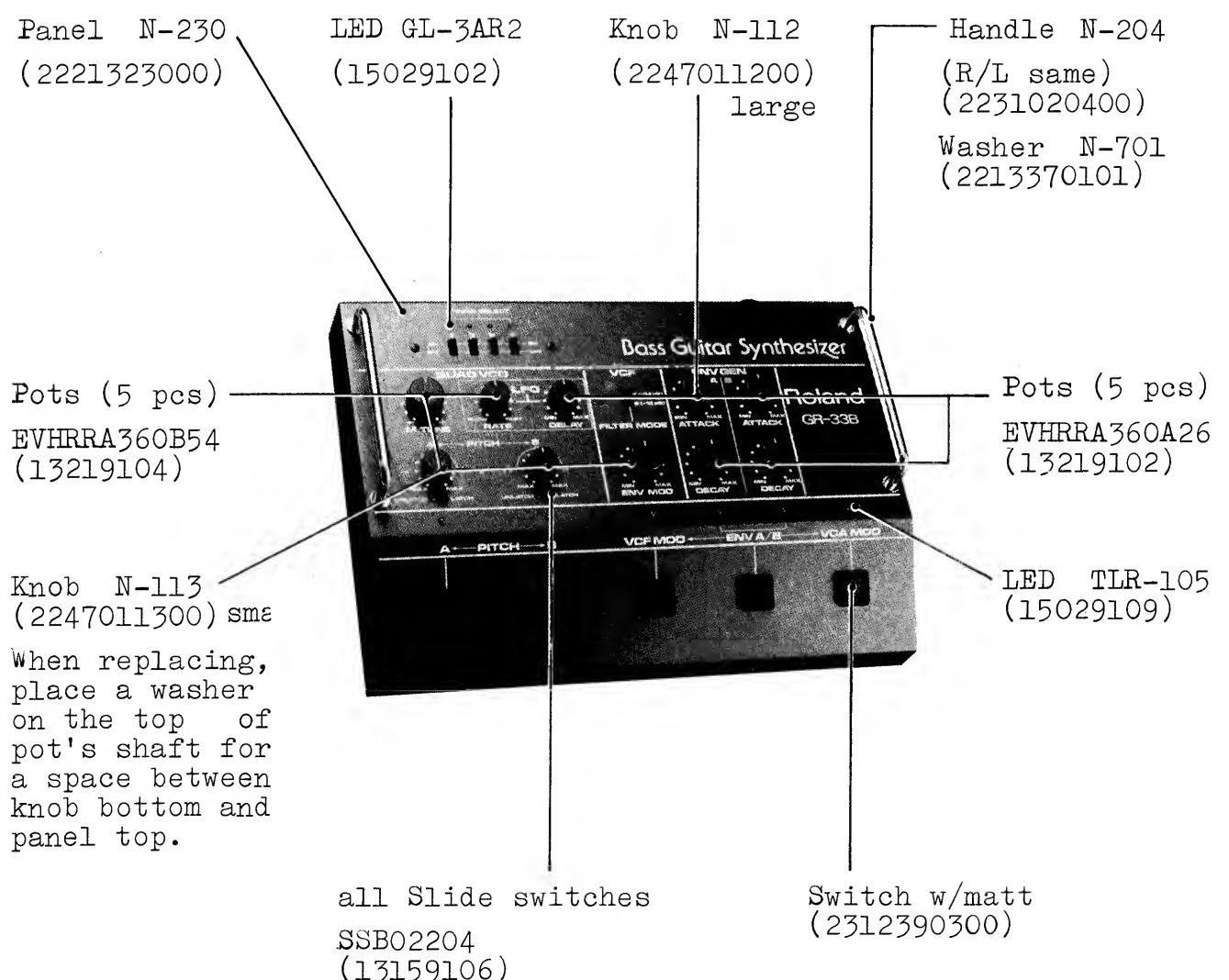
# GR-33B, G-33/G-88

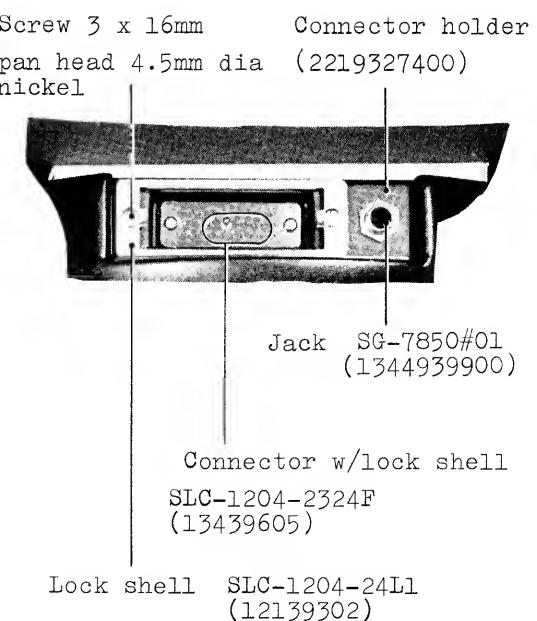
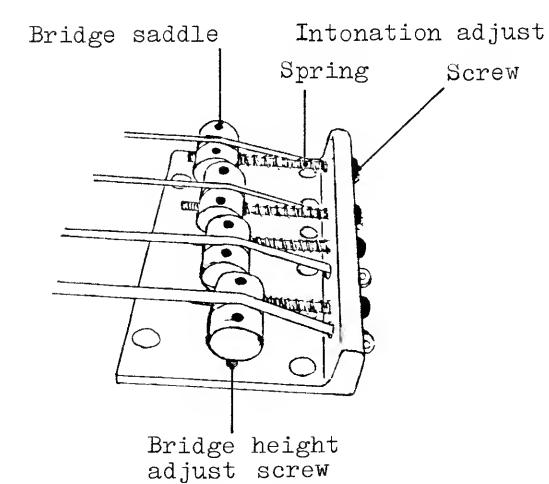
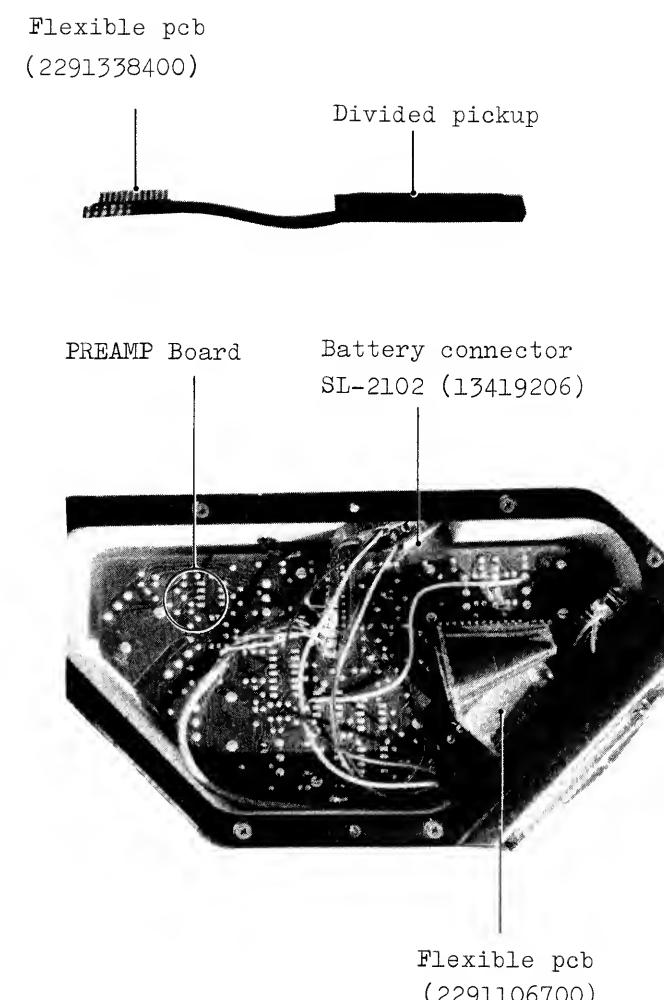
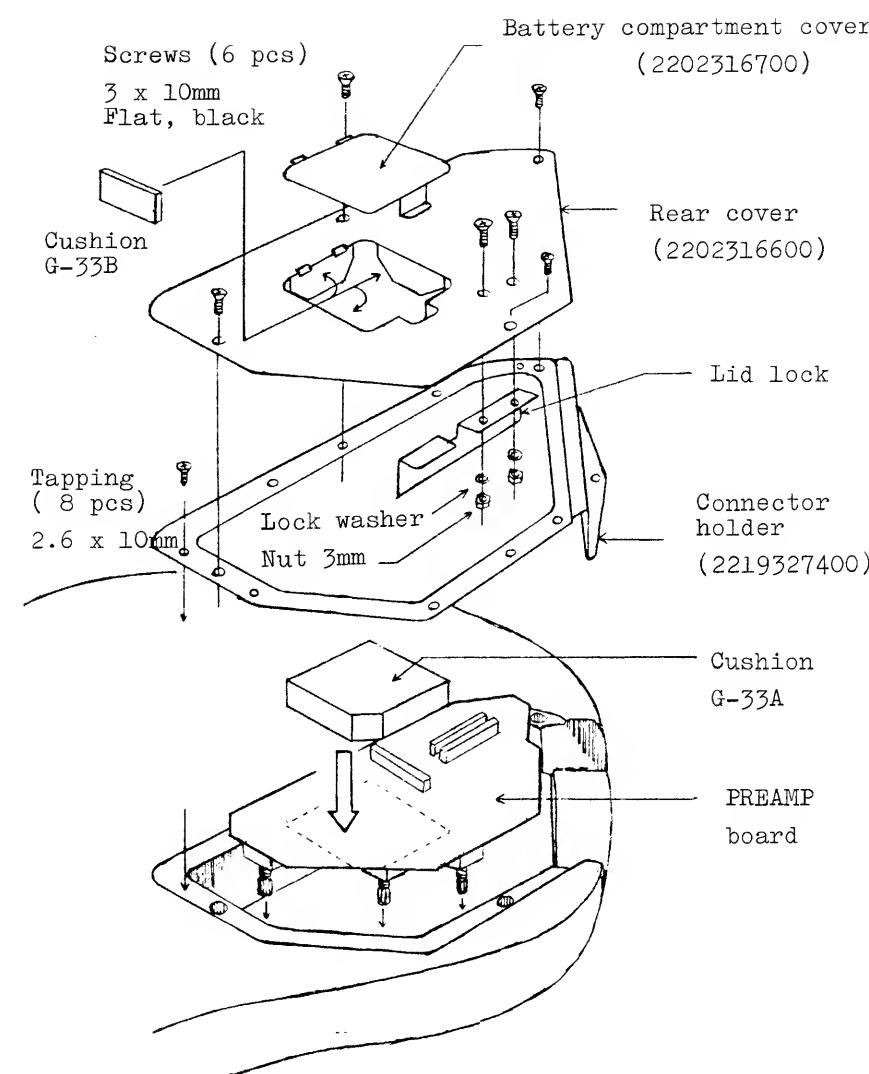
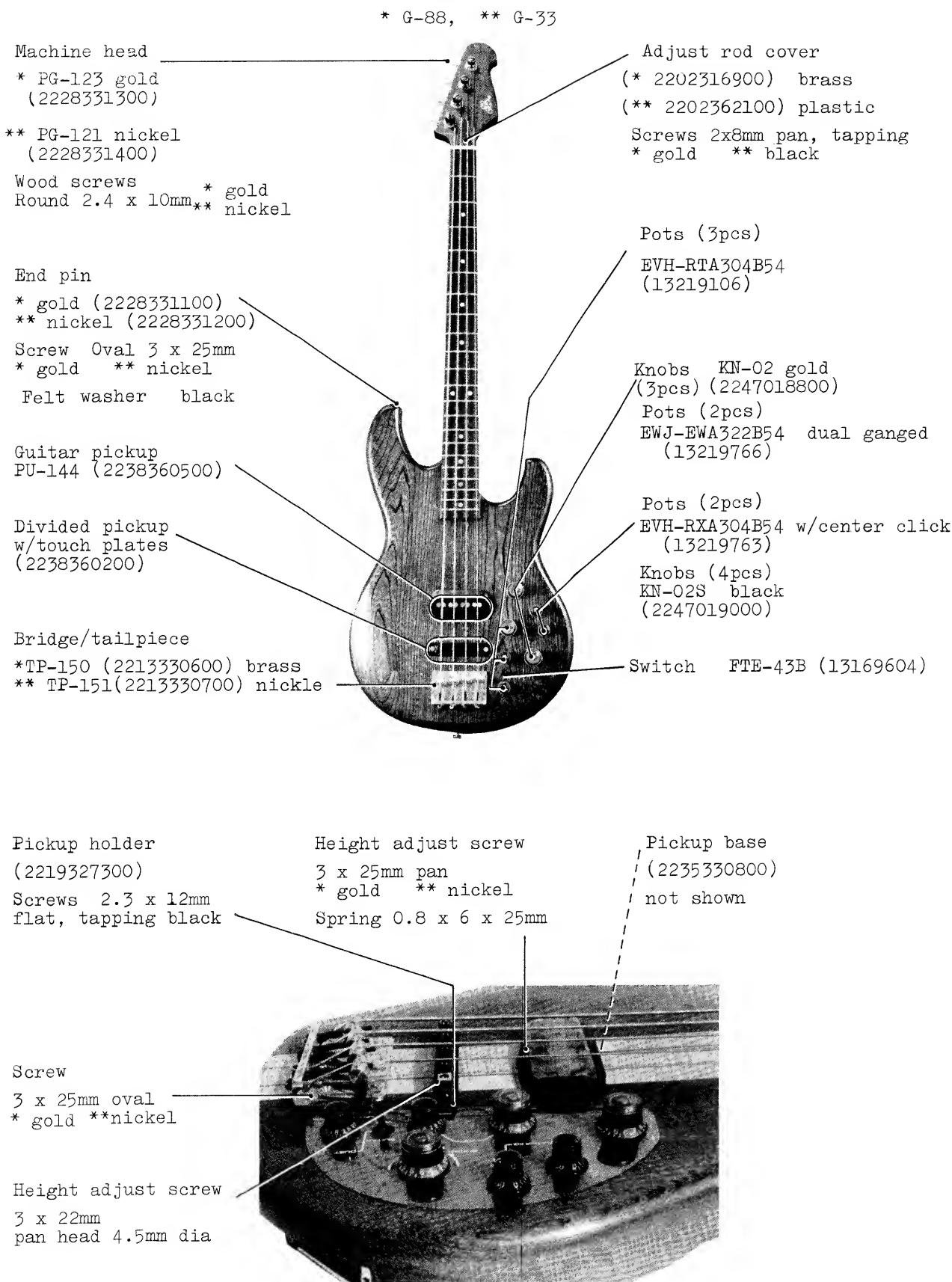
## SERVICE NOTES

### SPECIFICATIONS

PITCH SHIFT RANGE --- PITCH A/B:  $\pm 1300$  cents  
 ATTACK TIME ----- 0-3 seconds  
 DECAY TIME ----- 0-10 seconds  
 POWER CONSUMPTION --- 24 watts  
 DIMENSIONS ----- 400(W) x 290(D) x 100(H)  
 WEIGHT ----- GR-33B: 5Kg; G-33/G-88: 4.2Kg

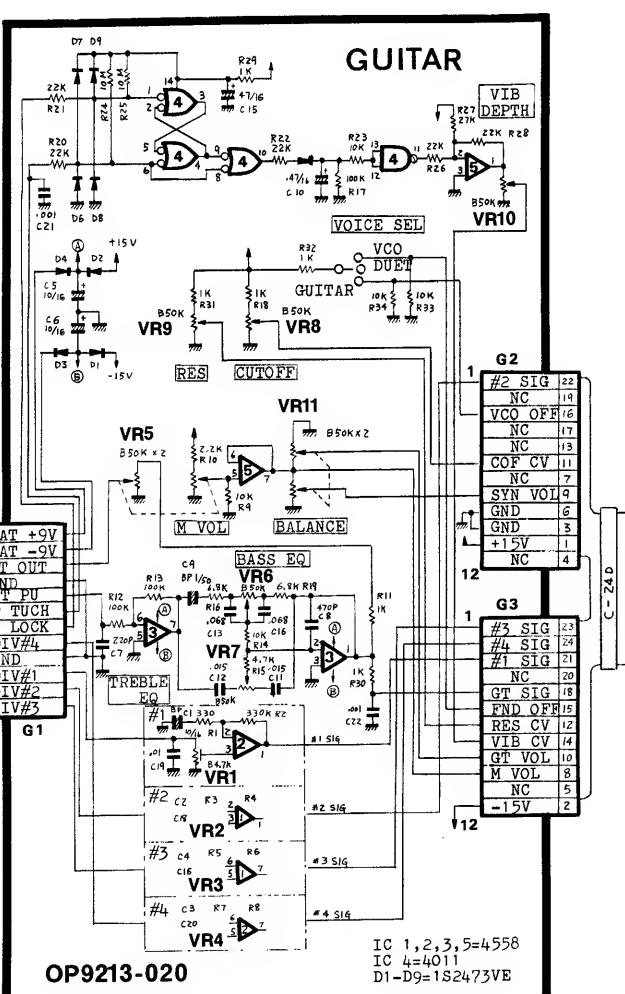
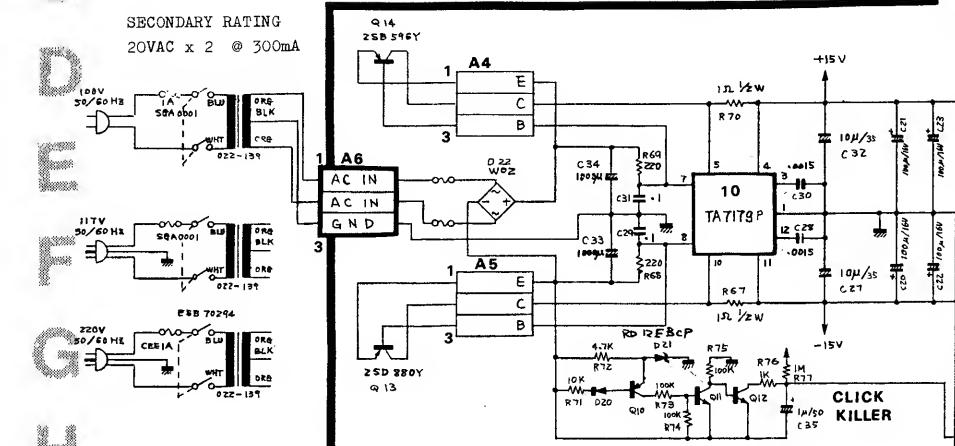
*First Edition*





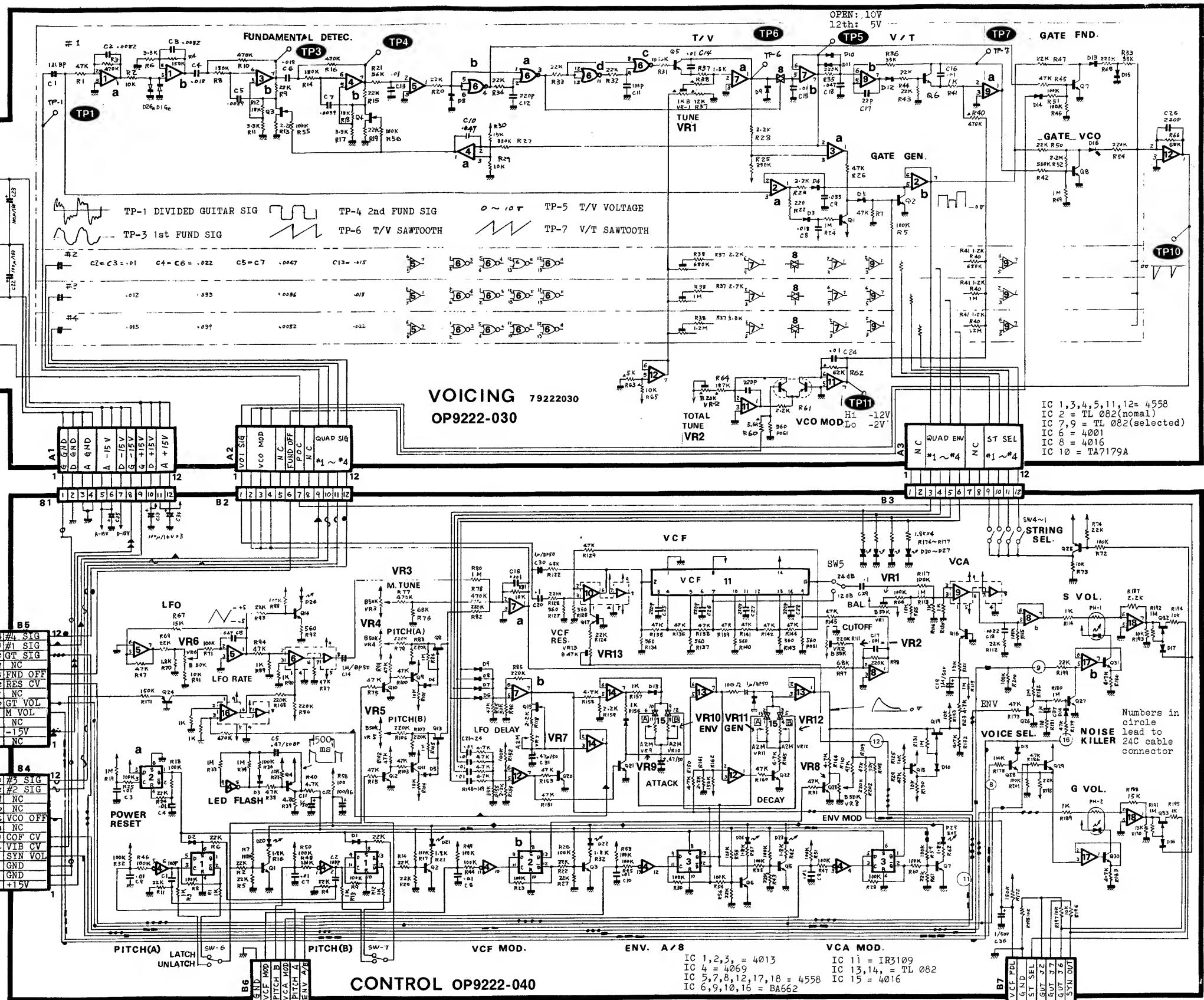


## GR-33B CIRCUIT DIAGRAM



OP9213-020

IC 1,2,3,5=4558  
IC 4=4013  
DI-D9=1S2473VE

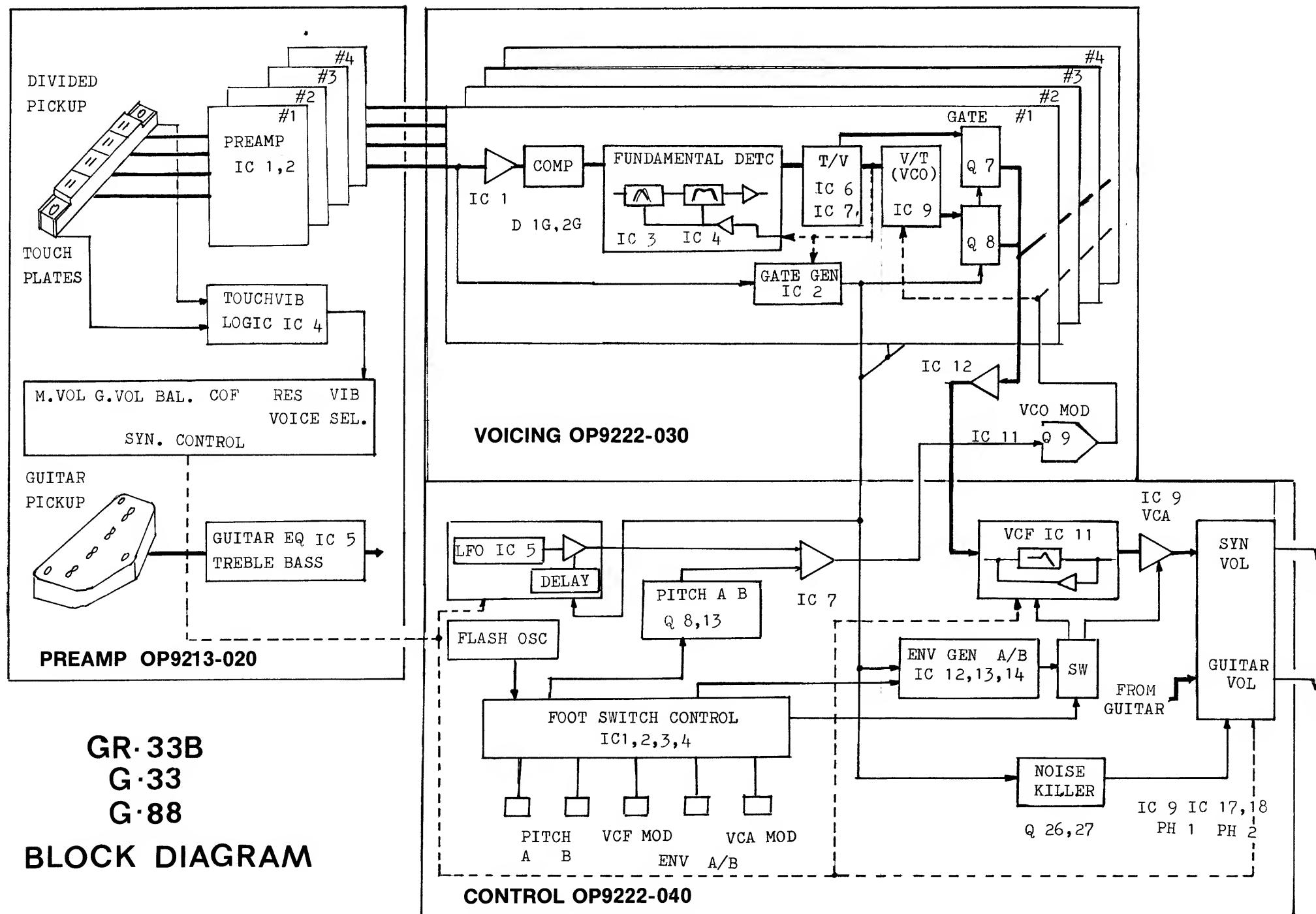


## CIRCUIT DESCRIPTION

GR-33B circuits are mostly built on two PCBs: Voicing Board OP-9222-030 and Control Board OP-9222-040.

VOICING BOARD OP-9222-030

1. FUNDAMENTAL DETECTOR
2. T/V CONVERTER
3. V/T CONVERTER
4. GATE GENERATOR
5. CHOPPER GATE
6. POWER SUPPLY



**GR-33B**  
**G-33**  
**G-88**

BLOCK DIAGRAM

## GR-33B

### 1. FUNDAMENTAL DETECTOR

This detector, the heart of GR-33B, strips incoming signals off harmonics and leaves fundamental. In the following, only channel #1 circuit is described since this detector is composed of the same four circuits.

The output signal coming from the divided pickup is applied through LPF/Buffer IC1a to COMPRESSION circuit consisting of clamp diodes D1-Ge and D2-Ge followed by another LPF IC1b.

### 1-1. Band-Pass Filter (BPF)

A two-stage filter, consisting of cascaded IC3b and IC4b, largely jumps its frequency response when a string is plucked with low fretting and then higher fretting, and vice versa. When channel #1 string at lower fret(0-6th) is played, Q3 and Q4 are cut off by the potential from IC4a whose pin 2 is kept positive with respect to pin 3 by T/V output (IC7b). Q3 and Q4, during off, make 1st and 2nd filters' component values the same to provide overall peak frequency at F1 that corresponds to fundamental of the

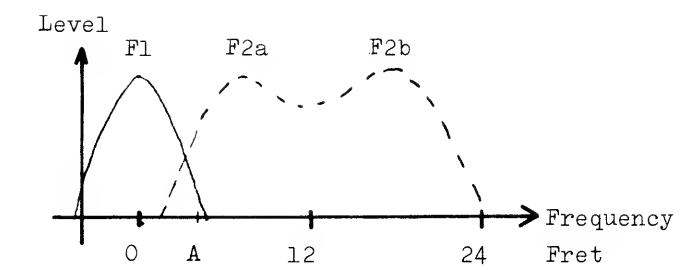


Fig. 1 Filter changes frequency response according to the fret position.

open string. The filter attenuates the 1st overtone or 2nd harmonic content in the passing signal by 24dB.

Picking string with a fretting higher than point A in Fig. 1 causes IC7b to output voltage below that on IC4a pin 3 whose output turns to positive. Q3 and Q4, during conducting period, connect R13 and R19 to circuit, making filters' constants different to each other. Resultants are discrete peak frequencies: F2a (frequency around 5-6th frets) from IC3b and F2b (around 18th) from IC4b. Second harmonics of fret-notes in this region are also rolled off by 24dB.

### NOTE:

These response curves do not affect sound volume since signal flowing through the filter is used only for pitch determinant. The fundamental is trimmed into squarewave in comparator IC5 and is fed to the next stage, T/V converter IC6, Q5 and IC7.

### 2. T/V CONVERTER

This circuit is composed of two-stage monostable multivibrator IC6(MM1,MM2), constant-current integrator Q5, IC7a, D9, and sample and hold circuit IC8 and IC7b.

MM1 and MM2 output low width positive-going pulses c and d upon receiving edges of respective inputs. There is time lapse with c and d due to the time constant of R38 and CMOS's input capacitance.

The voltage across capacitor C14 increases linearly when charged at a constant rate and decreases to zero when pulse d triggers Q5. The voltage across D9 (pin 7 of IC7a) takes the shape of sawtooth e. Its maximum value is proportional to the time interval between two pulses: 0-10V at open string, and 0-5V at 12th fret. The square wave from MM1 serves as a fundamental in DUET mode. The waveform is sampled by  $\frac{1}{4}$ IC8 each time pulse c is applied and is held by C15 before being reset by pulse d. DC output from IC7b is then applied to IC9b.

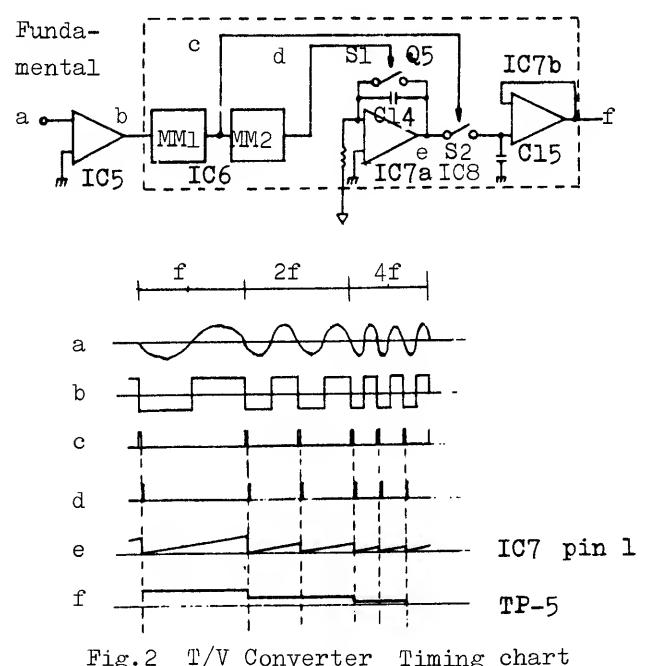


Fig.2 T/V Converter Timing chart

### 3. V/T CONVERTER (VCO)

This V/T converter is similar to the T/V Converter in operation. When the charge on C16 increases constantly and reaches the potential equal to that on C18, it causes output from IC9b to conduct Q6 taking the shape of sawtooth waveform whose amplitude is inversely proportional to fret frequency, that is, the lower the fret, the higher the amplitude. This VCO waveform can be modulated or shifted by varying the current flowing into C16. The more the current, the faster charges C16 up to the level on C18. As a result, VCO frequency increases with its amplitude held constant.

### 4. GATE GENERATOR

The gate generator comprises three circuits - Peak Hold: IC2a, D4 and C9; Reset: IC3a and Q2; Reset Disable: D3, C8 and Q1 - and GATE output IC2b.

#### 4-1. Peak Hold

When picked signal is applied to pin 3 of IC2a, it charges C9 through D4 during ATTACK time. The chargeable potential is proportionate to the signal peak and may be varied from picking to picking. IC2b delivers this voltage as a gate signal at a constant level until Q2 is fired by reset signal.

The signal level at IC2a pin 3 is decreasing after attack time is finished, to the level below that on pin 2 when IC2a turns pin 1 to negative going. D4 being reverse biased, C9 still holds previously charged voltage.

#### 4-2. Reset

Comparator IC3a senses voltage difference between the T/V and S/H outputs, which will be caused by complex harmonics content in string signal at picking and by 2nd harmonic at decay time. Voltage difference between pins 2 and 3 of IC3a turns pin 1 to positive that conducts Q2 via D5, turning IC2b pin 7 (gate out) to OV.

Reset signals that are inevitably presented to D5 anode should become inoperative during attack time to reproduce very important edge of sound. Below describes how this is done.

#### 4-3. Reset Disable

During attack time IC2a charges C8 through D3 and conducts Q1, shifting positive output voltage from IC3a pin 1 to below D5 forward bias voltage. Duration of this state is determined by C8 R24 time constant because D3 anode will go to negative after attack time is over as explained above in 4-1.

CONTROL BOARD OP-9222-040

The followings are main circuits on the board:

1. FOOT SWITCH CONTROL
2. LFO
3. VCO MOD (PITCH SHIFT)
4. VCF
5. ELECTRONIC VOLUME CONTROL

### 1. FOOT SWITCH CONTROL

Pressing the footswitch (momentary-close type) applies trigger pulse to C(clock) pin of flip-flops IC1-IC3 through buffer IC4. In this configuration D-F/F is connected as type T-F/F. Capacitor 0.01μfd across the switch prevents contact bounce (chattering) which could cause false triggering.

POWER RESET IC2a generates initial reset pulse for other F/Fs when the power is turned on. Outputs from LED FLASH IC4, D3, Q4 and F/F are ORed at the base of LED drivers Q1, 2, 3, 5, 6, 7. LED blinks at the rate of oscillator output when F/F is reset.

### 2. LFO

One half of IC5 forms hysteresis comparator and the rest half acts as a miller integrator, generating triangular output waveform. The waveform is directed to VCO MOD on VOICING brd via IC6 whose gain is current controlled by VIB DEPTH from Guitar Controller.

### 3. VCO MOD (PITCH SHIFT)

When PITCH A (B) is pressed, it causes Q8(Q13) connecting to pot PITCH A(B) to be turned on, voltage set by the pot is fed via IC7a to Q9 (anti-log) at VCO MOD on VOICING board.

### 4. VCF

One chip VCF (IC11 1R3109) comprising anti-log circuit makes up 24 or 12 dB/oct LPF along with its external Rs and Cs. The output is positively fed back to its input for resonant effect through Q17 and VCA IC10 whose gain or amount of resonance is controlled by RESONANCE on guitar controller.

When emphasis is high at a frequency, response curve lower than the peak frequency decreases in level, resulting in relatively small VCF output in this region. This detrimental effect is compensated for by parallelly feeding audio signals via VCA which controls amount of feedback and signals at the same rate.

Besides various control voltages, pitch control voltage is fed to VCF control pin via IC7a and IC8a to shift VCF cutoff point in accordance with pitch shift at VCO to maintain suitable filter band width.

Each GATE GEN output from VOICING board is summed at IC7b whose output level determines ENV GEN output level. The shape of ENV GEN output is determined by either A or B ATTACK and DECAY settings being selected by ENV A/B footswitch.

### 5. ELECTRONIC VOLUME CONTROL

Before being output from OUTPUT jacks, the audio signals are controlled their volumes by photoelectric cells PH1 and PH2 which in turn are remote-controlled at guitar controller.

Output from NOISE KILLER Q26 is also applied to PH1 through Q27. When ENV GEN outputs zero volts, IC17b is disabled, shutting in residual noises in the synthesizer channel.

G-33, G-88

G-33 and G-88 can be used as the ordinary electric bass guitar as well as a guitar controller dedicated to GR-33B. To make them operate as the bass guitar without connection to GR-33B, the circuits that process sound from single-coil pickup can operate from batteries built in.

### 1. BUFFER

To compensate for sensitivity variations among heads on quadruple pickup, outputs from IC1 and IC2 can be balanced in amplitude by adjusting individual trimmers (VR1-VR4).

### 2. TOUCH VIBRATO

When a player touches the one of Touch Plates, his body is connecting ground to pin 1 (6) of flip-flop (IC4- c, d), causing; (1) the pin voltage to drop below threshold, (2) F/F to reverse its output to L, (3) OR gate (IC4a) to output H, which is inverted through IC3, potential divided by VR10 and fed to connector G3. Since pin 1 of IC4a is led to the touch plate named P.TOUCH, pin 3 goes to L as soon as hand leaves off the plate.

## GR-33B

## G-33/G-88 ADJUSTMENTS

If tailpiece, bridge, truss rod and/or pickup(s) have been replaced on a given Guitar Controller, or if it seems to be aged or in such conditions under which appropriate play cannot be performed, proceed to adjustments in the order numbered:

1 PRELIMINARY; 2 TRUSS ROD; 3 STRING HEIGHT;  
4 STRING LENGTH

## PRELIMINARY ADJUSTMENT

Tighten the strings to eliminate slack.

Check Divided and Bass pickups for clearance from strings.

Lower the pickup, if the top face touches any strings, enough to allow of picking.

Tune the Guitar to playing pitch in Bass set-up.

## TRUSS ROD

- Checking Fingerboard and Neck for Cambered, Pulled, Twisted - see Fig. 1

Hold the neck joint with one hand(1); with the other hand, gently hold the guitar head(2). Position the guitar on the table.

View the curve of the fingerboard and neck across the top of the head from both edges alternately(3). With Bass guitar, neck of slight concave bend is considered ideal.

Fig. 1, A.

B to H in Fig. 1 are as examples would occur. Of course any combinations of these examples might be found on the guitar.

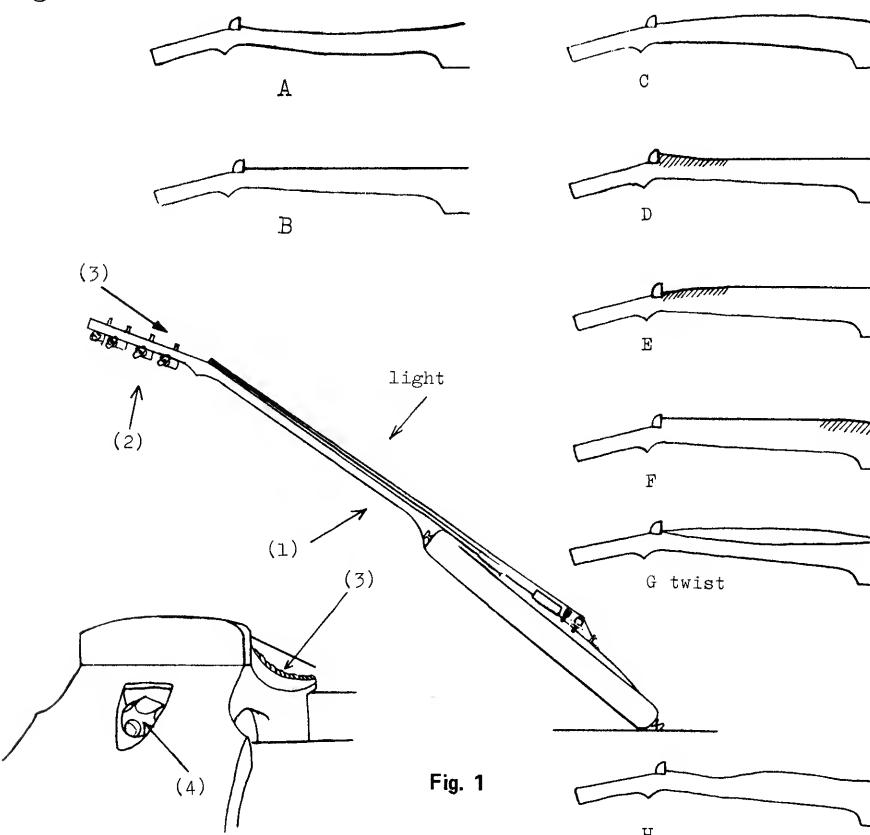


Fig. 1

To adjust truss rod, remove the rod cover. Tighten or loosen the nut(4) with an 8mm nut driver, small degree at a time while checking the result. DO NOT OVER TIGHTEN.

B, C, D -- Adjust truss rod. Check that there is no buzzing when the strings are played open. (Slight curvature dashed in D can be ignored.)

E, F, G, H -- When possible action cannot be obtained after compensation by truss rod adjustment, any adjustments it needs should be left to someone with experience on guitar repair.

## ACTION (STRING) HEIGHT

## - Bridge, Divided Pickup -

Since bridge height has great effect on divided pickup's sensitivity, adjustment for the one should be associated by for the other.

## PRECAUTIONS

Eliminate bridge whose stud(s) does not slip into grooves.

Fig. 2.

Bridge height and position on the bridge frame should be determined with the strings at tuned tension, which may be loosened slightly for easier bridge movement.

## BRIDGE HEIGHT

Action height adjustments must be taken with a full set of strings on the guitar, the gauge and type will be used, tuned to playing pitch.

With the strings open, measure the distance between 12th fret and the bottom of 1st and 4th strings.

Standard clearances: 1st -- 2.0mm, 4th -- 3.0mm Fig. 3

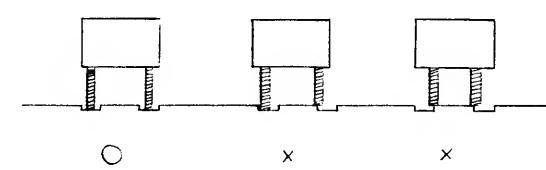


Fig. 2

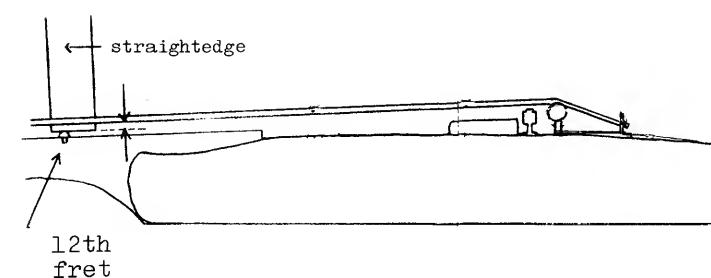


Fig. 3

To adjust bridge height, turn two adjustment nuts using hexagonal nut driver as shown in Fig. 4. Keep bridge top plane as parallel with bridge frame face as possible. Fig. 5

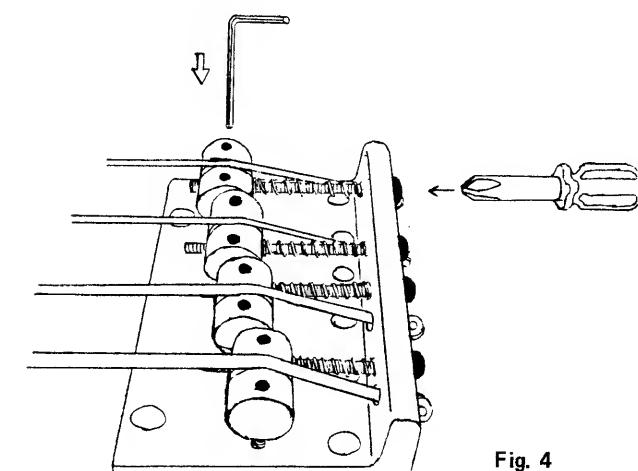


Fig. 4

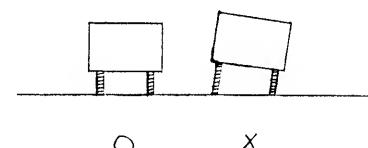


Fig. 5

## DIVIDED PICKUP HEIGHT

## - Coarse -

Raise divided pickup by turning height adjustment screws alternately until #1 and #4 heads contact with string. If #2 or #3 touches first, raise corresponding bridge.

(Re)-adjust #2 and #3 bridges' height for the same string contact as #1 and #4.

## - Fine -

After all strings rest on heads, readjust pickup height for the following clearances with respective string fretted at 21st.

Between #1 head top and string bottom --- 1.5mm

Between #4 head top and string bottom --- 2.0mm

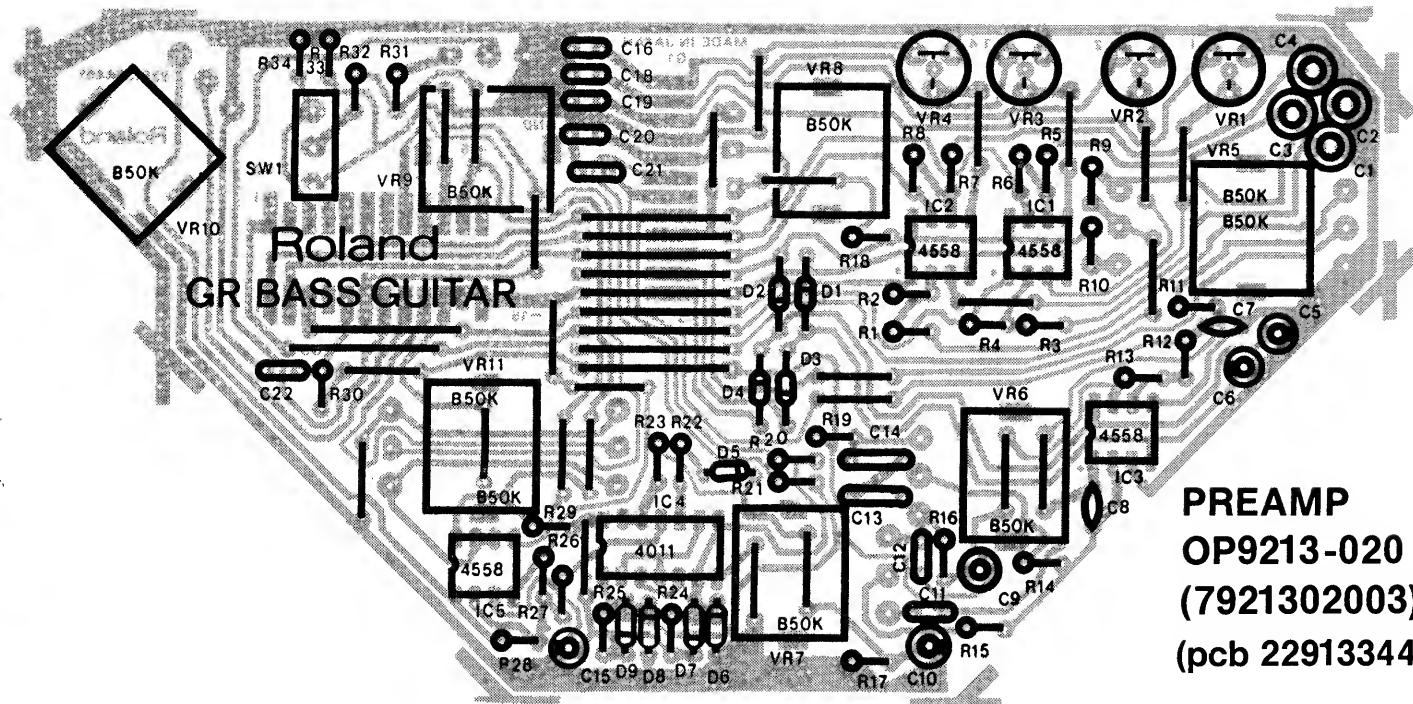
## STRING LENGTH (OCTAVE ADJUSTMENT)

Test intonation at the 12th fret whether string is sharp or flat in terms of overall intonation.

If a string is going sharp at the 12th fret, move back the bridge to add string length by turning the intonation adjustment screw at the bridge frame (Fig. 4). If flat, forwards.

## BASS GUITAR PICKUP (Single-Coil) HEIGHT

Possible action on guitar pickup (polepiece/string bottom) depends greatly on strings and players, with strings supplied 4-5mm works well. However, pickup's top surface must be held parallel to the strings.



## ADJUSTING VCE

DO NOT ATTEMPT THIS ADJUSTMENT PRIOR TO COMPLETION OF VCO TUNING

### CUTOFF FREQUENCY

1. Turn RES VR13 fully clockwise(FCW), through hole in the pcb from the foil side. VCF will resonate when a string is plucked.

2. Play string at open  
and adjust CUTOFF VR2  
for 5kHz. Fig. 1.

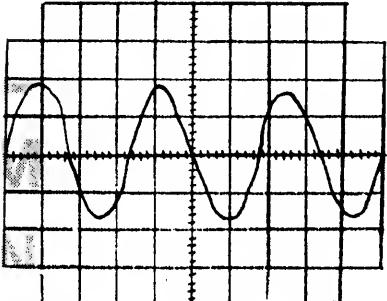


Fig. 1

## RESONANCE

1. With VR13 at FCW, reset CUTOFF FREQ on G-33/G-88 to 5.
2. Pluck 2nd string at open. Adjust VR13 for A:B = 2:1. Fig. 2.

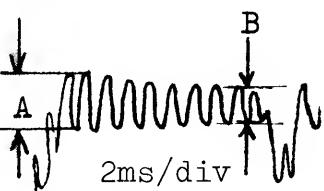


Fig. 2

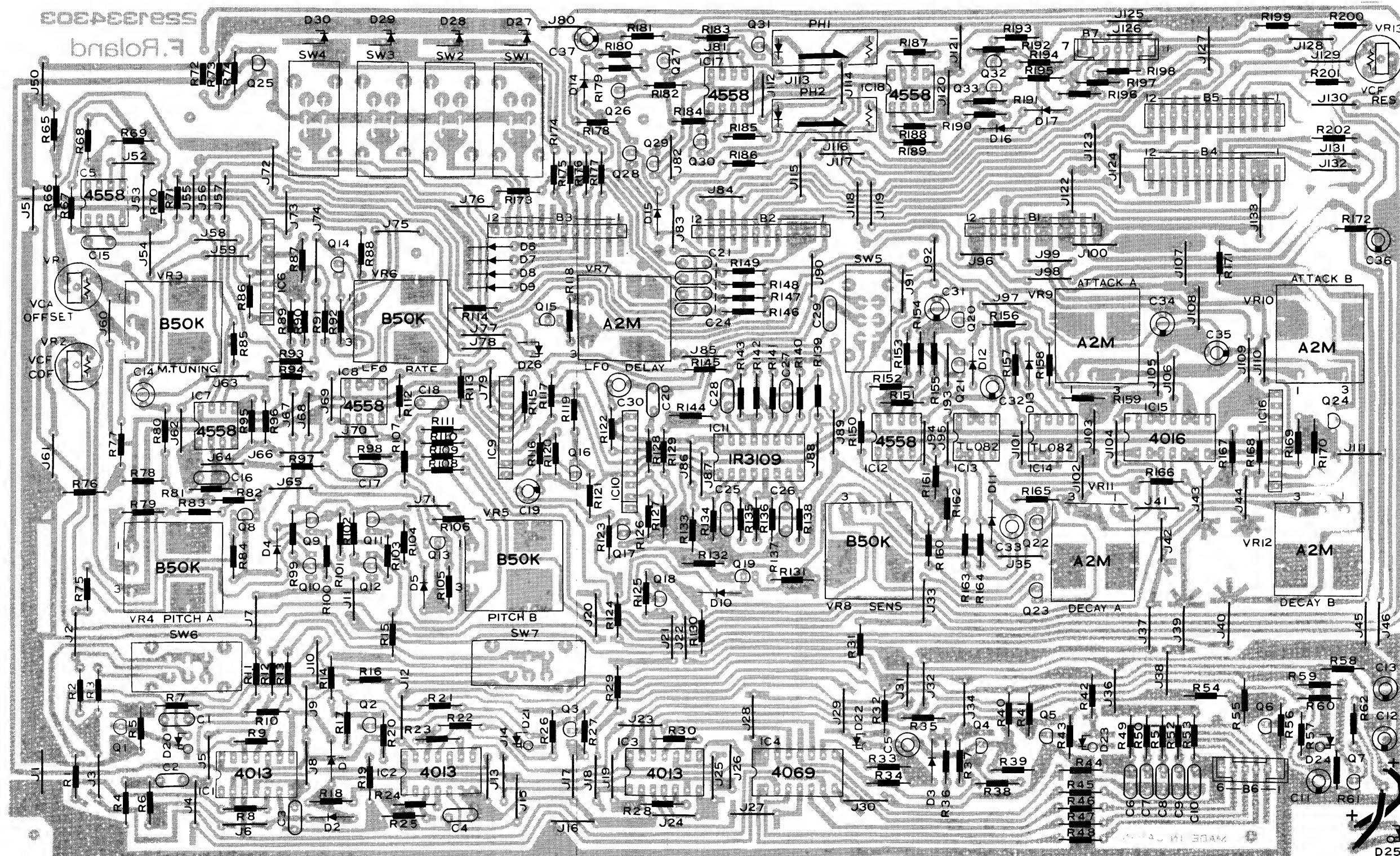
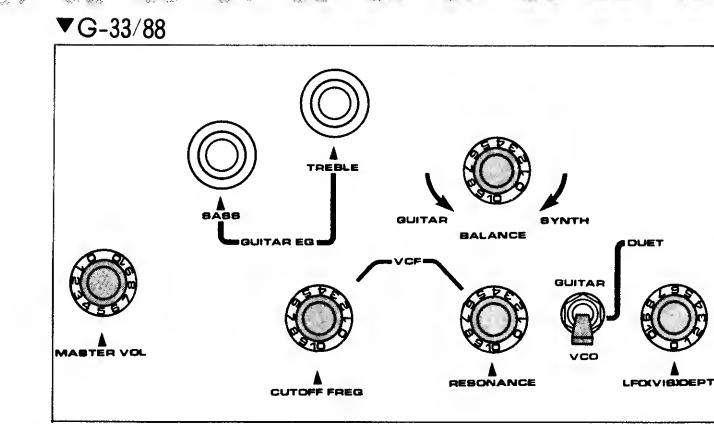
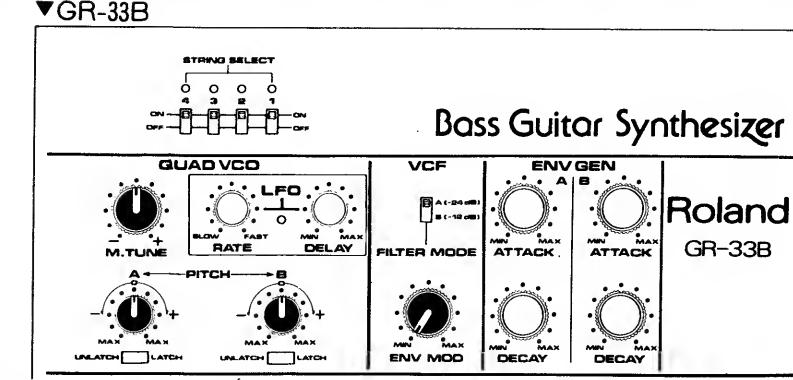
### VCA OFFSET BALANCE

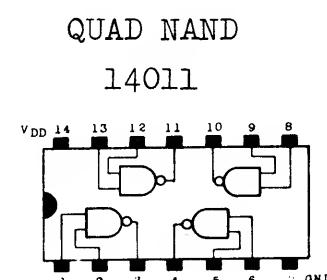
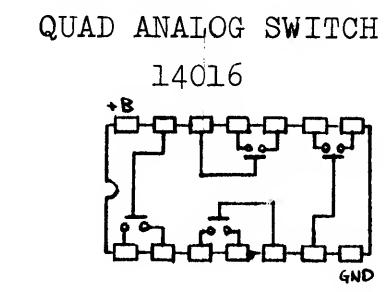
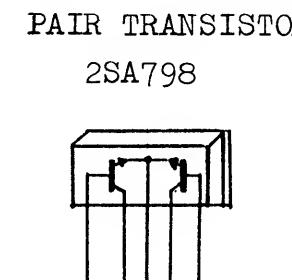
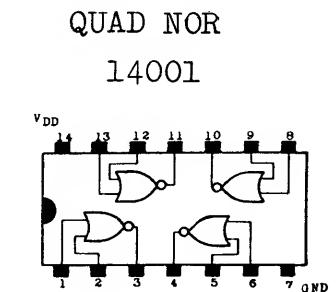
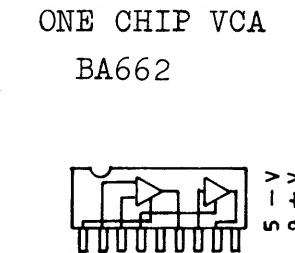
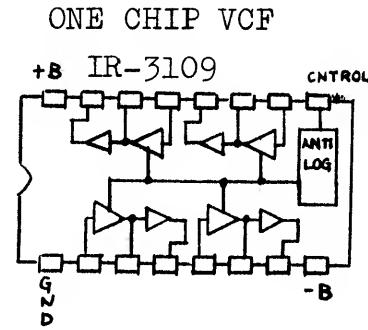
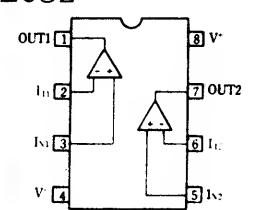
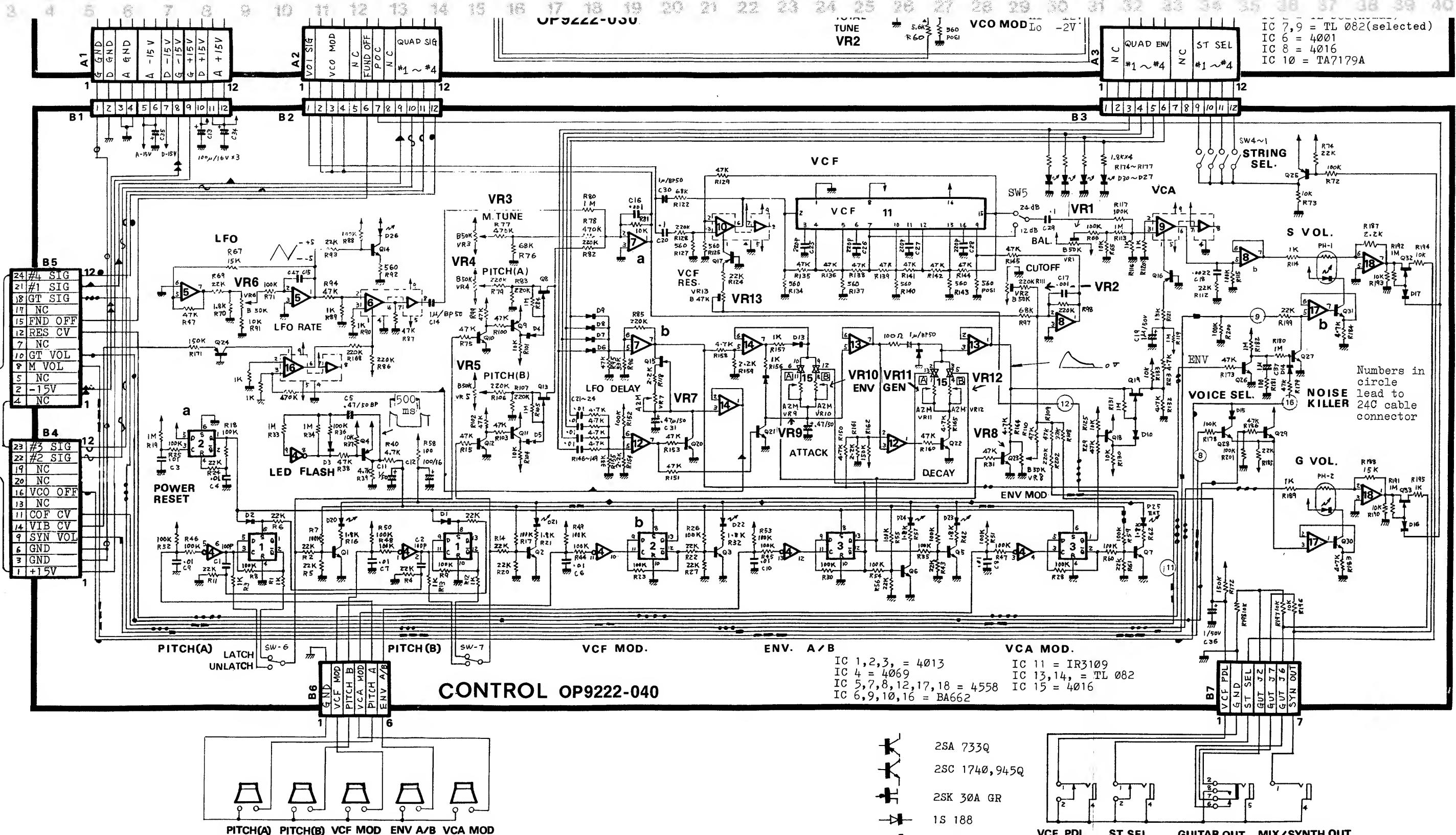
Set BAL VR1 for OV at IC8 pin 7 with no input signal applied.

GR-33E

Set controls as illustrated at the right (footswitches: all off). Connect oscilloscope to MIX/SYNTH jacks.

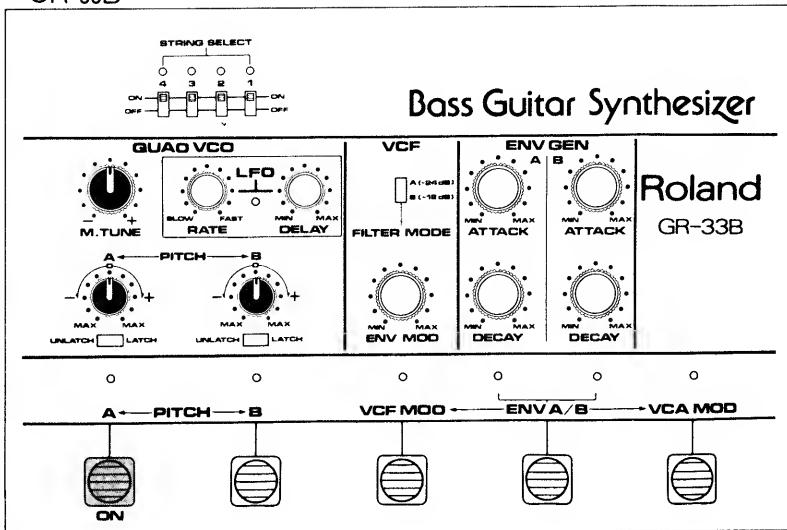
**CONTROL  
OP9222-040 (7922204001  
(pcb 2291334303)**



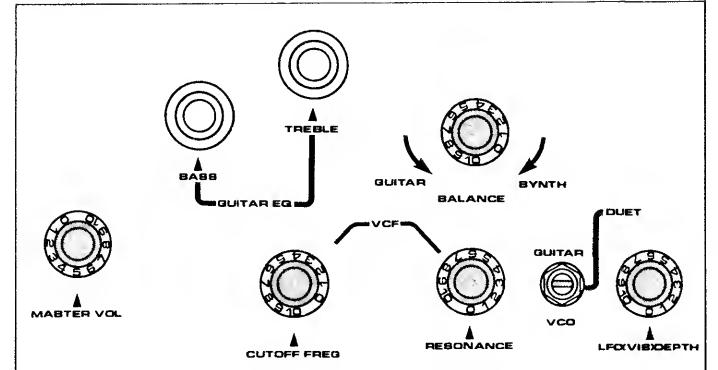


## GR-33B

▼GR-33B



▼G-33/88

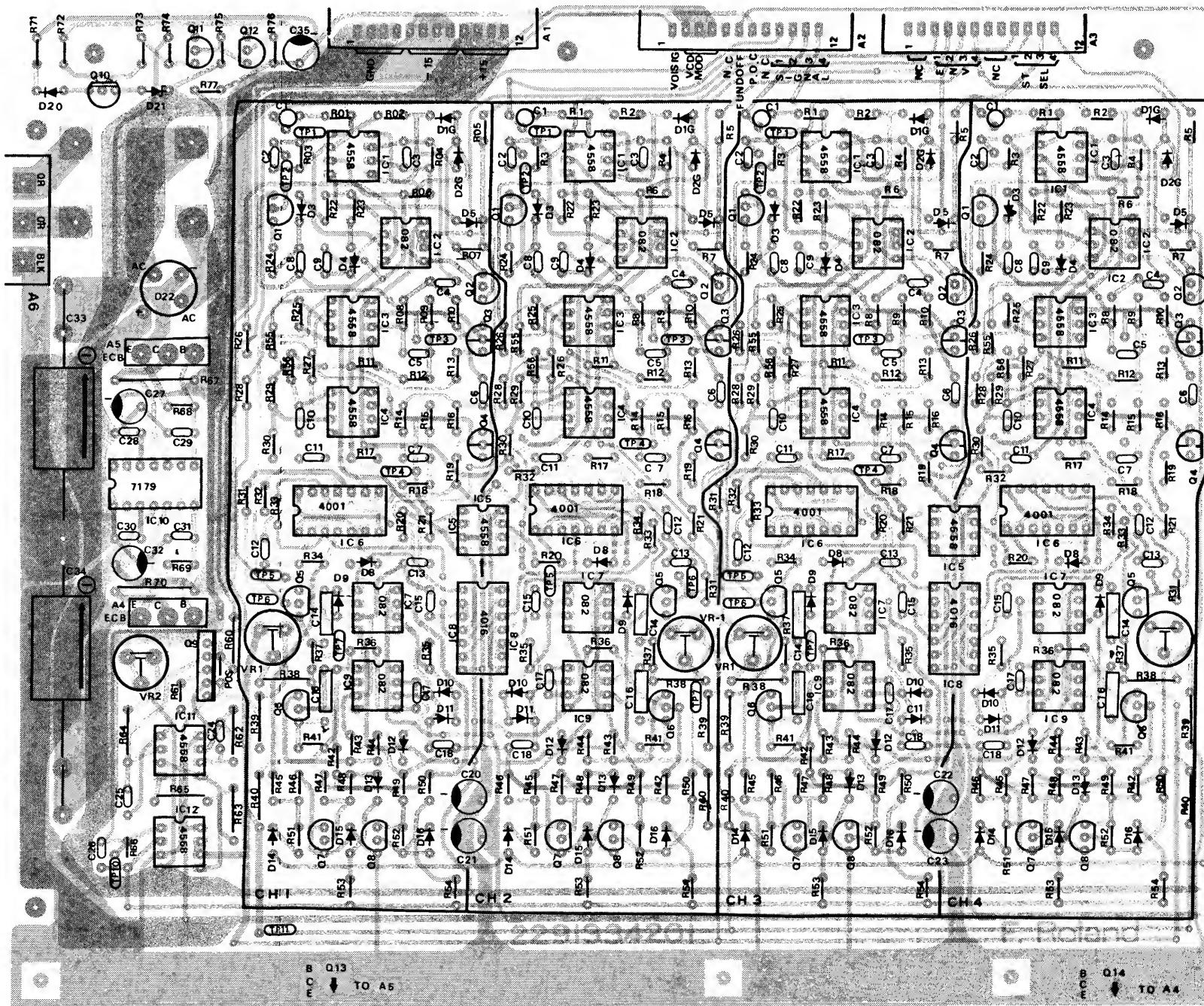
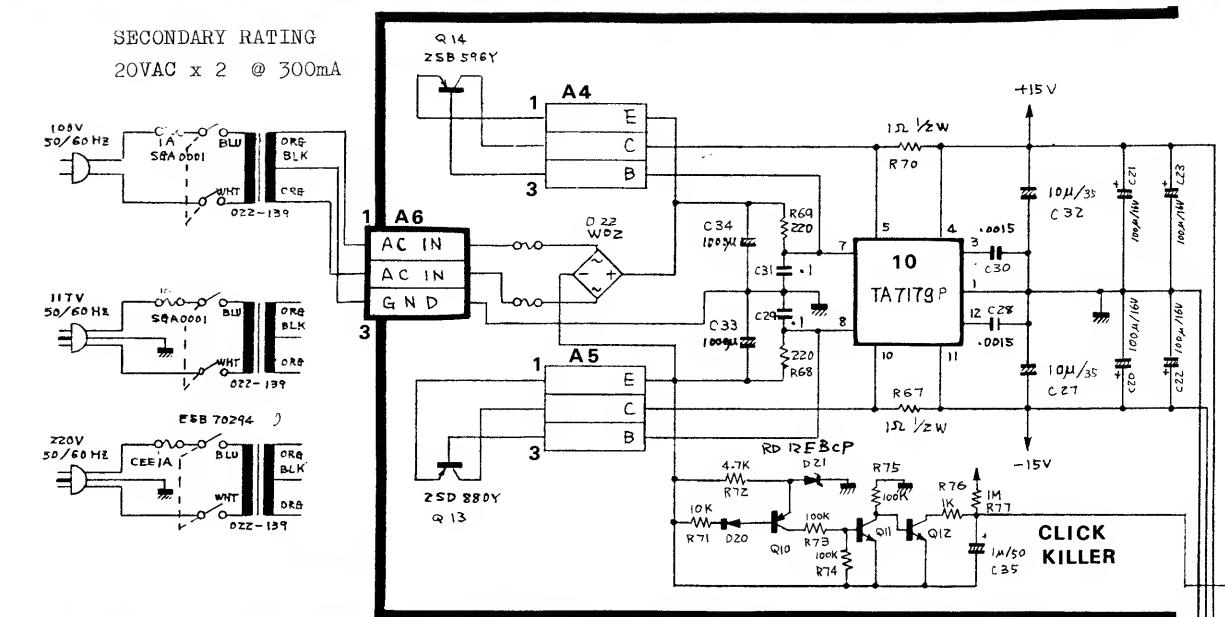


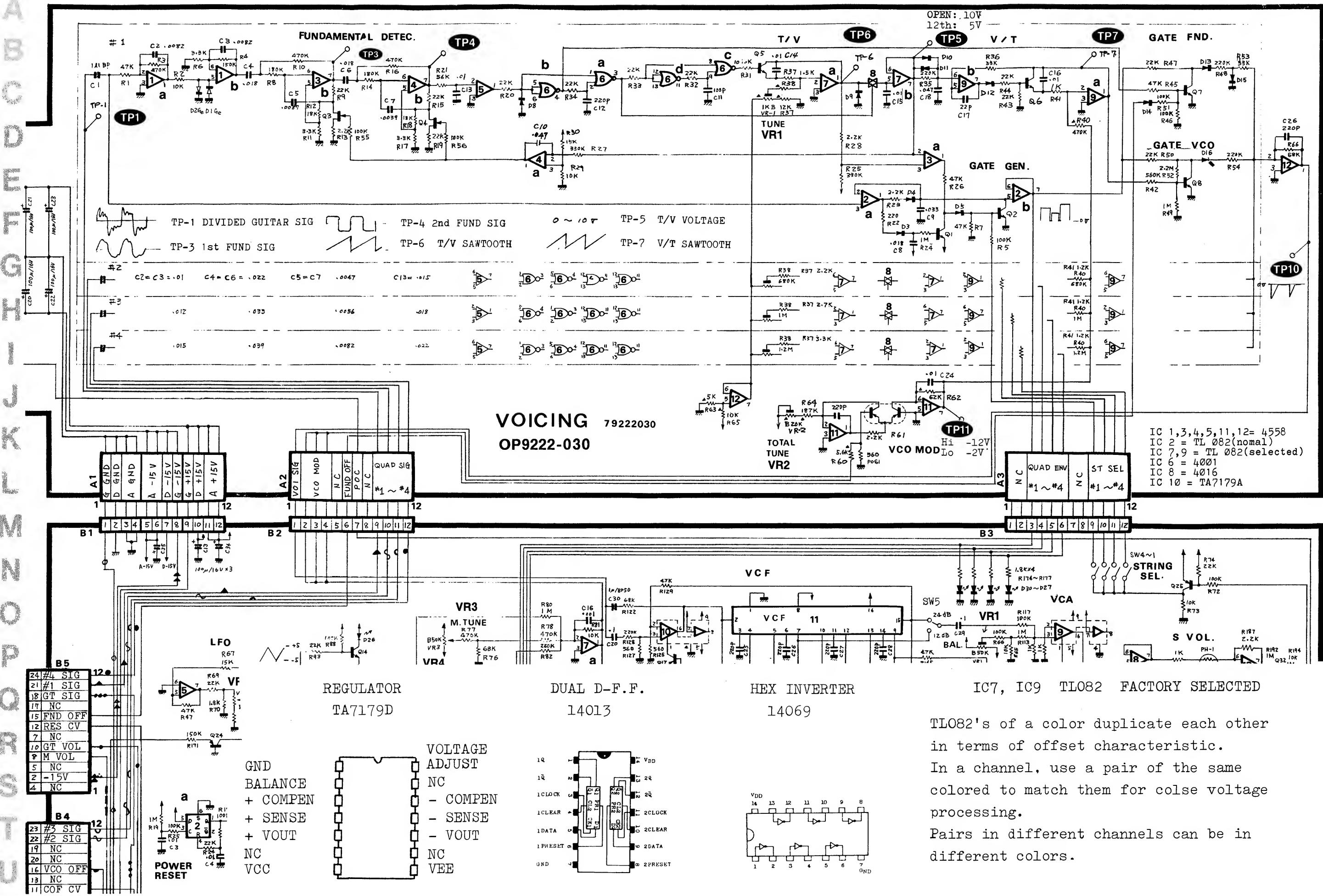
**VOICING BOARD**  
**OP9222-030(7922203002)**  
(PCB 2291334201)

Set controls on guitar controller and GR-33B as illustrated above.

1. Set each TUN VRL (#1-#4) at its midpoint.
2. Play on 1st string at 12th fret. Beat notes will be heard. Tune VCO by turning TOTAL TUNE(trimmer) VR2 until zero beat is heard. Do not turn VR1.
3. Pluck 2nd string with 12th fretting. Set VR1 on channel #2 for zero beat.
4. In the same manner tune #3 and #4 VCOs.
5. Check all strings for detune at open string and 21st fret notes.
6. Fine tune every VCO with VR1 over a string scale.

SECONDARY RATING  
20VAC x 2 @ 300mA





TL082's of a color duplicate each other in terms of offset characteristic.

In a channel, use a pair of the same colored to match them for close voltage processing.

Pairs in different channels can be in different colors.

## GR-33B PARTS LIST

## SEMICONDUCTOR

| Transistor            |  |            | CONNECTOR                             |                      |                             | SWITCH   |  |                                     |
|-----------------------|--|------------|---------------------------------------|----------------------|-----------------------------|--|--|-------------------------------------|
| <b>PANEL. CHASSIS</b> | 15119106                                     | 2SA733-    | P or Q                                | 13429405             | SLC-1204-2324F w/lock shell | 13169604   | FTE-43B                                | power                               |
| 2221323000            | Panel (front) N-230)                         | 15119108   | 2SA798-G                              | dual common emitter  | 12139302                    | SLC-1204-24L1 lock shell                           |  |                                     |
| 2231020400            | Handle (R, L same) N-204                     | 15119806   | 2SB596-                               | Y or O               |                             |  | <b>KNOB</b>                            |                                     |
| 2213370101            | Washer N-701 , hadle                         | 15129113   | 2SC1740-R                             |                      | 13429135                    | 5222-6A 6p   | 2247018800                             | KN-02G large                        |
| 2281322800            | Chassis N-228 (panel, bottom, w/rubber feet) | 15129815   | 2SD880-                               | Y or O               | 13429143                    | 5222-7A 7p   | 224701900                              | KN-02S small black                  |
| 2281322900            | Chassis N-229 power                          | 15139103   | 2SK30A-GR                             |                      |                             | 3022-12A 12p                                       |  |                                     |
| 2281021401            | Chassis N-214 rear, jack                     |            | <b>Diode</b>                          |                      | 2341320700                  | Connector/wiring assy N-207                        |  | <b>GUITAR</b>                       |
|                       |  | 15019122   | 1S188FM                               | germanum             | 2341020800                  | Connector/wiring assy N-208                        | 2238360200                             | Divided pickup                      |
|                       |  | 15019103   | 1S2473                                |                      | 13439604                    | SLC-1204-1324M (C-24D)                             | 2219327300                             | Pickup holder (D.pickup)            |
|                       |  | 15019108   | 1S2473FV                              | vertical mount leads | 13429404                    | SLC-1204-1324F (C-24D)                             | 2238360500                             | Pickup PU-144 Bass                  |
|                       |  | 15019236   | W-02                                  | rectifier stack      | 2291016700                  | Flexible PCB N-167 12p long                        | 2235330800                             | Pickup base (bass)                  |
| 2247011200            | Knob N-112 large                             | 15019548   | RD-12EBCP                             | zener                | 2291016600                  | Flexible PCB N-166 made out of N-167               | *2213330600                            | Bridge/tailpiece TP-150 brass       |
| 2247011300            | Knob N-113                                   | 15229909   | ERS-B33G561                           | posistor, 560 ohms   | 13429121                    | FH1-12S2.54DS 12P flexible PCB socket              | **2213330700                           | Bridge/tailpiece TP-151 nickel      |
| 2247051000            | Button N-510 power sw.                       | 15029109   | TLR-105                               | LED foot switch      |                             |  |  |                                     |
|                       |  | 15029102   | GL3AR2                                | LED                  |                             |  |  |                                     |
| 2312390300            | Switch N-903 foot w/matt                     | 15229702   | P-873A (red)                          | photocuplar          |                             |  |  |                                     |
| 13159106              | Slide SSB02204                               |            |                                       |                      |                             |  |  |                                     |
| 13129110              | Power ESB-70294                              |            |                                       |                      |                             |  |  |                                     |
|                       |  |            | <b>IC</b>                             |                      |                             |  |  |                                     |
|                       |  | 15189105   | uPC4558                               |                      |                             |  |  |                                     |
| 13449107              | SG-7630                                      | 15189118   | TL082                                 |                      | *G-88                       | **G-33   |  |                                     |
| 13449108              | SG-7630G green                               | 151891180A | TL082                                 | factory selected     |                             |  |  |                                     |
| 13449202              | SG-7640R red                                 | 15199110T0 | TA7179P                               |                      | 7921302003                  | <b>PCB ASSEMBLY</b>                                | 2219327400                             | Holder N-274 pcb housing frame      |
|                       |  | 15229802   | BA662A                                |                      | 2291334401                  | Preamp less parts                                  | 2202316600                             | Cover N-166 rear panel              |
|                       |  | 15229801   | 1R3109                                |                      |                             |  |  |                                     |
|                       |  | 15159101Z0 | MC14001BP                             |                      | 13219106                    | <b>POTENTIOMETER</b>                               | 2202316700                             | Cover N-167 battery compartment lid |
| 22450185N0            | PT-N-185 100V                                | 15159105Z0 | MC14013BP                             |                      | 13219763                    | EVH-RTA304B54                                      | 2219510600                             | Holder N-106 (trimmer)              |
| 22450186C0            | PT-N-186 117V                                | 15159106Z0 | MC14016BP                             |                      | 13219766                    | EVH-RXA304B54 center detent                        |  |                                     |
| 22450187D0            | PT-N-187 220/240V                            | 15159116Z0 | MC14069BP                             |                      | 13299113                    | EWJ-EWA322B54 50KB x 2 dual ganged                 |  |                                     |
|                       |  |            |                                       |                      |                             | SR19R 4.7K trimmer                                 |  |                                     |
|                       |  |            | <b>PCB ASSEMBLY</b>                   |                      |                             |  |  |                                     |
| 7922203002            | OP9222-030 VOICING                           |            | <b>POTENTIOMETER</b>                  |                      |                             |  |  |                                     |
| 2291334201            | Voicing less parts                           | 13219104   | FVHRR360B54                           | 50KB                 |                             | <b>SEMICONDUCTOR</b>                               |  |                                     |
| 7922204001            | OP9222-040 CONTROL                           | 13219102   | FVHRR360A26                           | 2MA                  | 15019108                    | 1S2473FV diode V-mount                             |  |                                     |
| 2291334303            | Control less parts                           | 13299116   | SR19RB47K                             | 47KB carbon trimmer  | 15189105                    | uPC4558  |  |                                     |
| 2291016600            | Flexible wiring N-166                        | 13299540   | CR19RB1k                              | 1KB metal            | 15159104Z0                  | MC14011B   |  |                                     |
| 2291016700            | Flexible wiring N-167                        | 13299544   | CR19RB22K                             | 22KB trimmer         |                             |  |  |                                     |
|                       |  |            | <b>RESISTOR</b>                       |                      |                             |  |  |                                     |
|                       |  |            | Metal film $\frac{1}{4}$ W 1% CRB25FX |                      | 13439605                    | SLC-1204-2324M 24 conductors w/locking shell below |  |                                     |
|                       |  | 13769227D0 | 5K                                    | 13769167D0           | 5.6K                        | 12139302   | SLC-1204-24L1 lock shell               |                                     |
|                       |  | 13769173D0 | 10K                                   | 13769175D0           | 12K                         | 1344939900   | Jack SG-7850#01                        |                                     |
|                       |  | 13769192D0 | 62K                                   | 13769244D0           | 187K                        | 13419206   | SL-2102 (battery connector)            |                                     |
|                       |  | 13769215D0 | 560K                                  | 13769217D0           | 680K                        | 13429121   | FH1-12S-2.54DS 12p flexible pcb socket |                                     |
|                       |  | 13769221D0 | 1M                                    | 13769249D0           | 1.2M                        |  |  |                                     |